NOTICE

All drawings located at the end of the document.

60397

RF/ER-95-0121.UN

Strategic Plan for the Management and Remediation of Groundwater at the Rocky Flats Environmental Technology Site

1/41

DRAFT

Strategic Plan for the Management and Remediation of Groundwater at the Rocky Flats Environmental Technology Site

Rocky Mountain Remediation Services, L. L. C.

Environmental Restoration/Waste Management

Sitewide Actions

December 1995

Revision 0

TABLE OF CONTENTS

FIGURES

TABLES

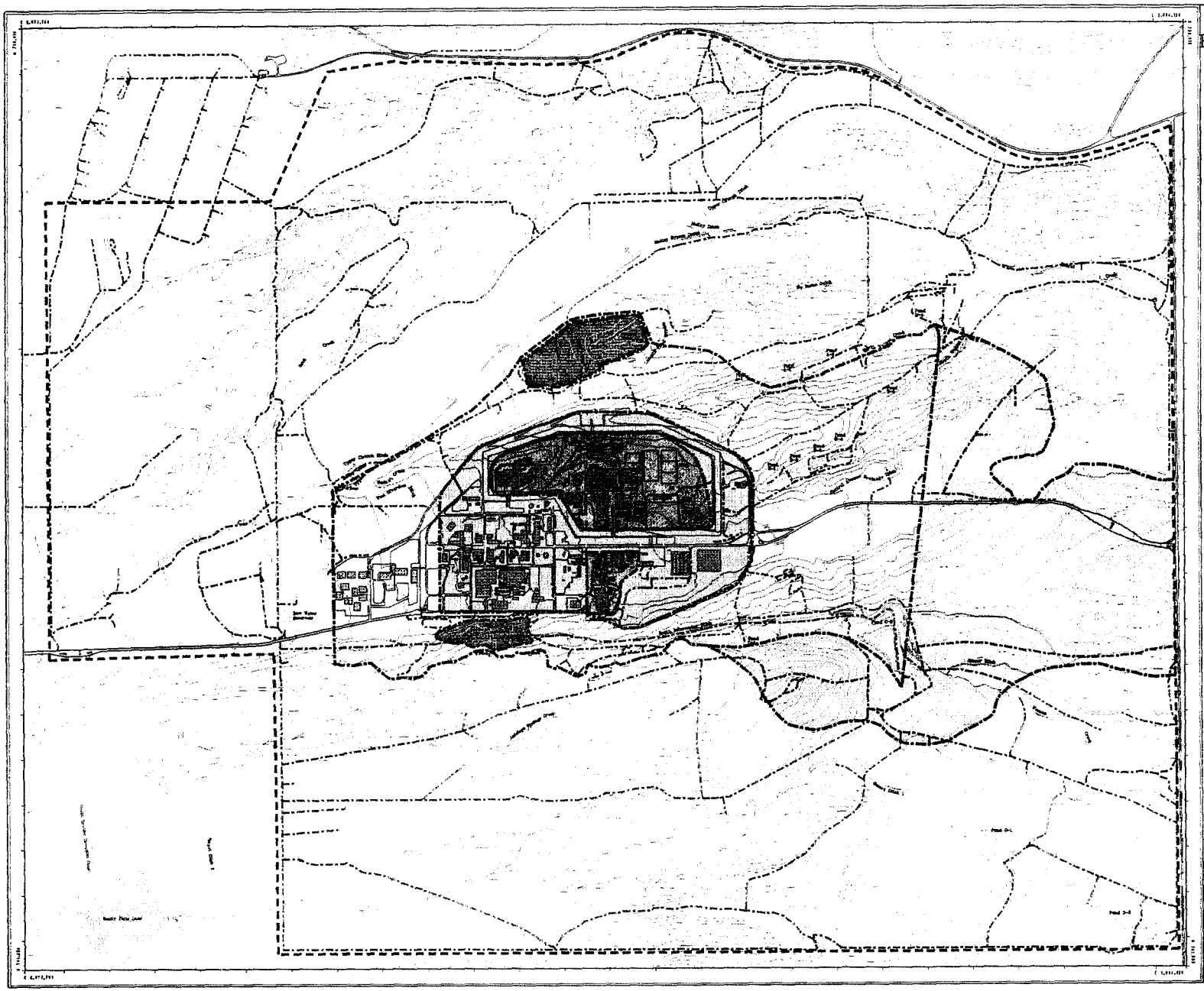
1.0 INTRODUCTION

The Groundwater Strategic Plan has been developed as a joint effort between the Department of Energy Rocky Flats Field Office (DOE/RFFO), Kaiser-Hill, L. L. C. (KH), Rocky Mountain Remediation Services, L. L. C. (RMRS), the Environmental Protection Agency (EPA), Region VIII, and the Colorado Department of Public Health and Environment (CDPHE). The strategic plan incorporates the draft Rocky Flats Conceptual Vision (November 8, 1995), and technical guidance from the Groundwater Strategy Working Group and the Standards Working Group.

The Rocky Flats Conceptual Vision identifies the proposed future land uses for the Rocky Flats Environmental Technology Site (RFETS) (see Fig. 1-1). The Vision recognizes that RFETS cannot be returned to a pristine condition; however, four future land uses are defined. These uses include (1) capped areas underlain by waste disposal cells or contaminated materials closed in-place, (2) an industrial area (IA), (3) an inner buffer zone managed as open space, and (4) an uncontaminated outer buffer zone that will be managed as open space which could be used for any purpose. Low-level radioactive and hazardous waste will be left onsite in a stable configuration, and there will be an interim period during which Special Nuclear Material (SNM) and transuranic (TRU) radioactive waste will remain onsite. SNM and TRU will be moved offsite by 2015 if the Waste Isolation Pilot Plant, or other acceptable repository for SNM, is available to receive the materials.

The groundwater strategy is directly related to the cleanup of contaminated soil and the protection of surface-water quality. Soil cleanup will make the land safe for industrial use in the IA and for open-space use in the buffer zone. Soil cleanup will be protective of groundwater and ultimately of surface water. Groundwater cleanup will focus on protecting surface-water quality. Use of onsite groundwater will not be allowed. This prohibition against using onsite groundwater will protect hydraulic gradients (vertical and horizontal) and preserve the open-space character of the land. Nevertheless, groundwater quality offsite and in Area 3 (see Fig. 1-1) will be protective for all uses. Surface-water cleanup will protect the surface-water quality for specified uses. In Area 2, surface-water quality will be protective of the ecology. In Area 3 and offsite, surface-water quality will be protective of all uses. On completion of Option B (Woman Creek Reservoir and Broomfield alternative water supply), surface water downstream of the site will not be used as a public water-supply. Therefore, surface water crossing the site will not affect domestic water supplies. Accordingly, the surface water crossing the site could be reclassified for aquatic and recreational uses, and not for the drinking or domestic water supply.

Decision criteria for remediation are based on elimination, treatment, consolidation, containment, and management of contaminated soils, water, and other materials. Remediation will reduce the



F1-1 Conceptual RFETS Vision

Explanation of Future Conditions

- Area 3- Outer Buffer Zone (4477 Acres)
- Area 4- Low-level Pu Soil Contamination, surface only (586 Acres)
- Area 2- Inner Buffer Zone (719 Acres)
- Area 1- Industrial Area (260 Acres)
- Area 0- Closed Landfills (53 Acres)
- Area 0- Cap (130 Acres)

Standard Map Features

- Buildings or other structures
- Lakes and ponds
- Streams, ditches, or other drainage features
- Fences
- Contours (20' Intervals)
- Rocky Flats boundary
- Paved roads
- Dirt roads

DATA SOURCE:
Buildings, roads, and fences provided by Facilities Engr. - EG&G Rocky Flats, Inc. - 1991.
Hydrology provided by USGS - (date unknown)

500 0 1000 2000ft

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD27

U.S. Department of Energy
Rocky Flats Environmental Technology Site
MAP ID: RFETS-Vision November 02, 1995

/home/fs514678/projects/kaiser-hill/close-rev2.aml

impact to natural resources and will be protective of reasonably anticipated future land and water uses. Cleanup levels for soil, groundwater, and surface water are designed to minimize vertical and horizontal migration of contaminants. Because some waste will remain onsite (i.e., residual contamination in some areas), long-term care for the site will be required.

1.1 PURPOSE OF THE GROUNDWATER STRATEGY

Groundwater at RFETS is present in the subsurface throughout the site. In the past, each Operable Unit (OU) investigated groundwater within its boundaries without addressing influences from upgradient sources. However, groundwater is not limited by OU or Individual Hazardous Substance Site (IHSS) boundaries. Several sources may contribute to a single groundwater plume, and groundwater plumes may contribute to surface-water contamination at some distance from the source location. Therefore, a sitewide technical and regulatory strategy has been developed to address groundwater issues at RFETS.

Addressing groundwater on a sitewide basis will allow for effective coordination of groundwater activities, a consistent approach to addressing groundwater contamination, and establishment of consistent remediation goals. Development of a sitewide groundwater strategy also means that surface-soil remediation can be performed independent of groundwater remediation. Overall, the programmatic goals are to protect human health and the environment on and offsite, limit potential contaminant migration (to the extent possible), protect other possible beneficial uses of the water, and comply with applicable or relevant and appropriate regulations (unless waiver are issued).

The specific goals of the Strategy Plan are to:

1. Provide a Strategy consistent with the Vision and the Action-Level Framework for surface water, groundwater, and soils;

2. Identify and describe the salient groundwater plumes;

3. Rank the groundwater plumes in accordance with the method outlined in the"Environmental Restoration Ranking"(September 1995); and

4. Provide an initial planning basis for work package development and funding.

To meet these goals, the strategy proposes source removal, where possible; provides for source control, where necessary; and provides for the treatment of dissolved-phase plumes, where

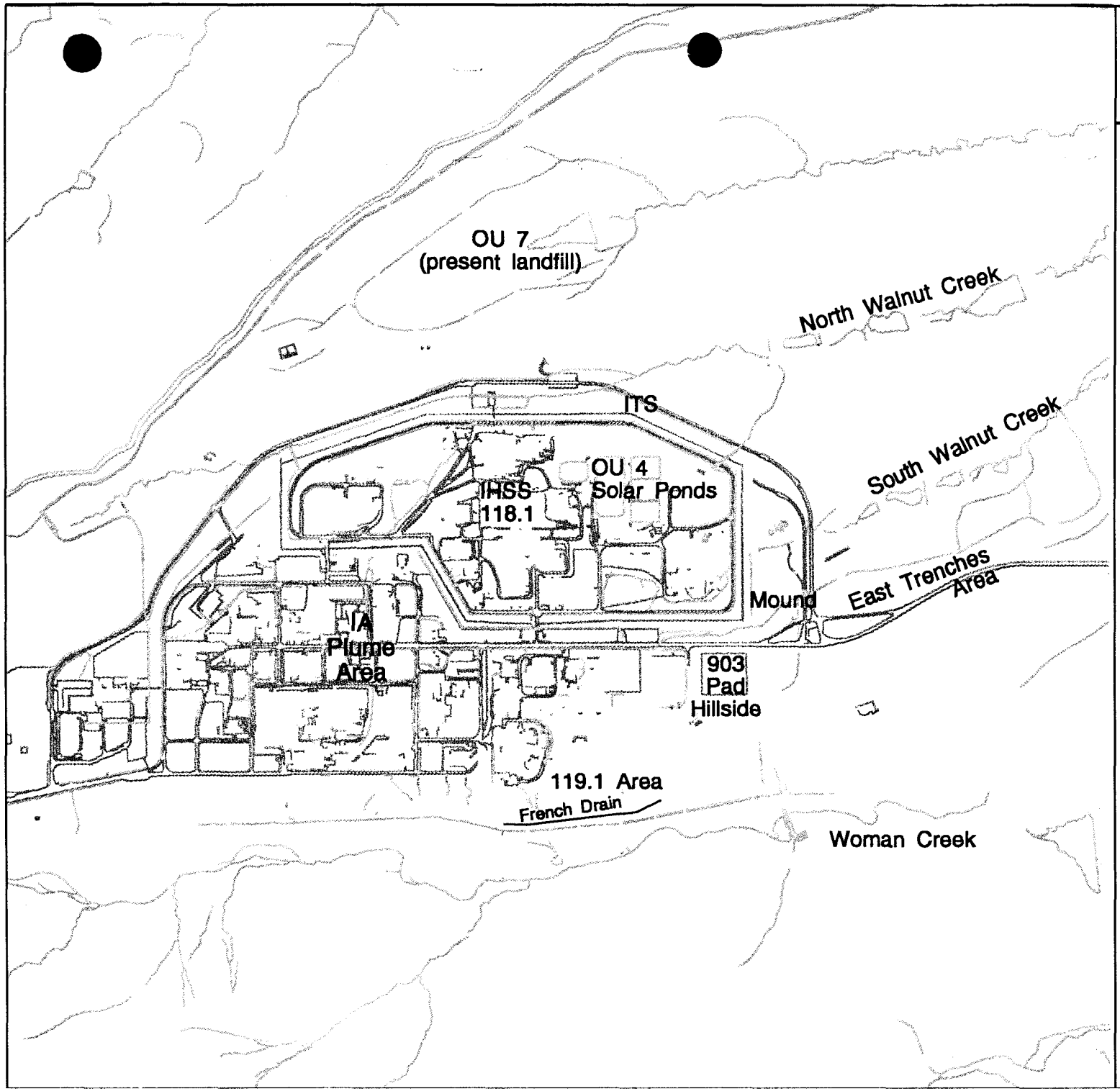
necessary. The strategy includes an evaluation whereby some areas of contaminated groundwater may remain in place if the goals of the strategy can be met without active intervention.

1.2 DOCUMENT ORGANIZATION

The strategy for groundwater restoration is presented in seven sections: (1) Section 1.0 provides an introduction, describes the goals and purpose of the groundwater strategy, and presents the organization of the report; (2) Section 2.0 provides a summary background on groundwater at RFETS; (3) Section 3.0 presents the cleanup standards and approach developed by the working group for surface water, groundwater, surface soil, and subsurface soil; (4) Section 4.0 describes the various groundwater contaminant plumes present at RFETS and provides an overview of the remediation techniques that will be used; (5) Section 5.0 describes the monitoring associated with groundwater restoration and plume management; (6) Section 6.0 presents the proposed schedule of remedial activities; and (7) Section 7.0 summarizes the strategy and presents the conclusions.

This document also contains two appendices: (1) Appendix B contains the text of the draft Conceptual Vision for RFETS, used as the basis for the groundwater strategy; and (2) Appendix C contains the draft Action-Level Framework for Surface Water, Groundwater, and Soils.

Figure 1-2 is a location reference map showing the central portion of RFETS. The principal areas discussed in the text are indicated by annotations.



Location Reference Map

Location of areas of interest refered to in text.

N

500 0 500 1000 Feet

Figure 1-2

2.0 GROUNDWATER AT RFETS

The term "aquifer" is defined in 6 CCR 1007-3, Section 260.10 as "geologic formation, group of formations, or part of a formation capable of yielding a significant amount of groundwater to wells or springs." Based on this definition, much of the shallow saturated material at RFETS does not constitute an aquifer because the yield of water to wells is typically low, and broad areas often become dry during fall and early winter months. Nevertheless, because these shallow saturated materials may be capable of transporting contaminants that pose a risk to human health or the environment, the interpretation of what constitutes the uppermost "aquifer" at RFETS relies instead on hydrologic and geochemical data that demonstrate hydraulic connection between distinct lithostratigraphic units within the shallow materials. These data indicate that groundwater flow can be described as occurring through at least two discernible hydrostratigraphic units present at RFETS. These units are generally referred to as the upper hydrostratigraphic unit (UHSU) and lower hydrostratigraphic unit (LHSU).

The UHSU is the predominant water-bearing unit of concern at RFETS. It consists of surficial deposits (alluvium, colluvium, and artificial fill) as well as weathered bedrock and minor bedrock sandstones hydraulically connected to the alluvium. The LHSU consists of unweathered claystone, with minor interbedded siltstones and sandstones. There is a significant difference in hydraulic conductivity (K) between the UHSU and the LHSU. This suggests that the LHSU effectively acts as a hydraulic barrier to downward flow. Generally, however, neither the UHSU nor the LHSU has sufficient transmissivity to be developed as a water source for residential use, although some isolated bedrock sandstones and valley-fill alluvial materials could provide sufficient water to support limited household-use in selected locations.

Groundwater in the UHSU preferentially flows along pre-existing channels cut into the bedrock. These channels are known to occur in the IA, Solar Ponds, 881 Hillside, 903 Pad and East Trenches Areas. In addition, groundwater in the IA may preferentially flow along buried sewer lines and process-waste lines. Groundwater in the surficial deposits of the UHSU flows to the east, following bedrock and surface topography and discharges to surface drainages where surficial deposits are intersected by drainages. These drainages are the main groundwater pathways offsite. The surface-water flow onsite is controlled by artificial impoundments in these drainages.

The location and extent of contaminant plumes are relatively well known outside of the IA; however, the same level of confidence does not exist for plumes within the IA. The known plumes pass through more than one source area; for example, the plume attributed to the Solar Ponds also contains contaminants from an upgradient source. At least one IA contaminant

source has impacted water quality in the Walnut Creek drainage. It is not yet clear whether any additional plumes from the IA will have an impact on water quality in other drainages.

The available hydrogeologic and isotopic data suggest that faults are not significant conduits for downward vertical groundwater flow to deep aquifers. Evidence of limited hydraulic communication between UHSU and LHSU groundwater was found to exist in some wells, but these occurrences do not present a consistent pattern with known fault locations. Isolated fractures in unfaulted bedrock, as opposed to fault zone fractures, are implicated as the most likely mode of transport for UHSU groundwater to reach unweathered bedrock. Due to the thickness and lithology of the aquitard, it is likely that fault zones become more impermeable with depth, thus reducing the potential for any shallow groundwater flow to the Laramie/Fox Hills aquifer.

Detailed studies of the hydrogeology are presented in the "Hydrogeologic Characterization Report for the Rocky Flats" (April 1995). Detailed studies of the geology are presented in the companion document, "Geologic Characterization Report of the Rocky Flats Environmental Technology Site." (March 1995). Plume configurations used in the Strategy were derived from the 1995 Well Evaluation Project.

3.0 ACTION LEVELS AND CLEANUP STANDARDS/GOALS

Surface water, groundwater, and soil cleanup are interrelated, and the Groundwater Strategy Working Group considered all three media in developing a sitewide strategy for RFETS. The draft Conceptual Vision for RFETS places heavy emphasis on preserving the quality of surface water to most defined uses and preventing the transport of contaminants offsite through a surface-water pathway. Protection of surface water is the primary driver for the cleanup and stabilization of contaminated subsurface soil and groundwater at RFETS.

The result of the Standards Working Group, (DRAFT) Action-Level Framework for Surface Water, Groundwater, and Soils (December 11, 1995) is attached as Appendix C. The parties have not reached agreement on all of the text in this document. The Standards Working Group incorporated a graded approach to cleanup, based on the phase of remediation and decontamination and decommissioning (D&D) at the site. The period of active remediation and D&D will be called the "Active" phase in this document; the phase following remediation and D&D (while SNM and TRU waste remain onsite), will be referred to as the "Intermediate" phase; and the "End State" phase will be achieved when all SNM and TRU wastes have been removed from the site. The working group(s) recognized that remediation and D&D will generate temporary increases in the levels of contaminants potentially available for release. The working group reached consensus that protection of surface water, with respect to achievement of the Vision, would be the basis for making interim soil and groundwater remediation and management decisions. However, during the active periods, surface-water standards and surface-water management will be different than those applied during the intermediate and End-States. The design of systems should include meeting action levels and cleanup standards upon completion of the remediation plans. Although operation of groundwater systems are anticipated to continue through this intermediate phase and potentially the end-state. The following sections summarize the approaches delineated in the draft Action-Levels document for monitoring and remediation of surface water, groundwater, and subsurface soils.

3.1 SURFACE WATER

Some of the proposed surface-water standards differ from the existing site-specific surface-water standards. These proposed standards will require review and approval by the Colorado Water Quality Control Commission (WQCC) before such changes are promulgated. CDPHE has agreed to approach the WQCC with DOE and KH to change these standards. Modification requests for the surface-water standards will provide sufficient rationale and justification to document that standards will be protective of actual uses, or that the standards are reflective of background levels

at RFETS. After the changes to the standards have been finalized, the new standards established by the WQCC will be applied to onsite surface water.

Points of compliance or evaluation, at which the new standards or goals must be met, as well as the ramifications of standards exceedances, are delineated in the draft Action-Level Framework (See Appendix C). A detailed discussion of surface-water standards, action levels, and points of compliance for the Active phase and the End-States is included in Appendix B.

3.2 GROUNDWATER

Action levels for groundwater must be protective of surface-water quality and ecological resources. As stated in the draft Conceptual Vision, domestic use of groundwater at RFETS will be prevented through institutional controls. Because no other human exposure to groundwater is foreseen by the Vision, groundwater action levels are not based on human health protection. This framework for groundwater action levels assumes that all contaminated groundwater emerges as surface water before leaving the site.

3.2.1 Action Levels

The strategy for groundwater is intended to prevent contamination of surface water. This protectiveness will be achieved by applying federal Maximum Concentration Limits (MCLs) as groundwater standards (see Appendix C). A two-tier approach to groundwater remediation and monitoring is presented in the following paragraphs.

Tier-I

Action levels were developed to drive near-source remediations in areas where groundwater contamination exceeds 100 x MCL levels for organic contaminants. These action levels are designed to identify groundwater contaminant sources that present a higher potential risk to surface water and that should be addressed through an accelerated action. If Tier-I action levels are exceeded, an evaluation is required to determine if remedial or management action is necessary to prevent more highly contaminated (i.e., contaminant concentrations >100 x MCLs) groundwater from reaching surface water. If action is necessary, the type and location of the action will be delineated and implemented as an accelerated action. Additional groundwater that does not exceed the Tier-I action levels may also need to be remediated or managed to protect surface-water quality or ecological resources. The plume areas to be remediated and the cleanup levels or management techniques used will be determined on a case-by-case basis.

Tier-II

The action levels for surface-water protection were developed to prevent contaminated groundwater from reaching surface water, by triggering groundwater management actions when necessary. A detailed discussion of where Tier-II standards will be measured is found in Section 3.2 of Appendix C. A subset of existing groundwater monitoring wells will be designated as Tier-II monitoring locations. Additional Tier-II monitoring wells may be installed, if necessary. The following paragraph reflects the recommend option made by the Working Group regarding Tier-II wells triggering action (see Section 3.3 of Appendix C).

If concentrations in a Tier-II well exceed MCLs during a regular sampling event, monthly sampling of that well will be required. Three consecutive monthly samples showing contaminant concentrations greater than groundwater standards will require a groundwater remedial action. These actions will be determined on a case-by-case basis and will be designed to treat, contain, manage, or mitigate the contaminant plume. Such actions will be incorporated into the Environmental Priority List and will be given weight according to measured impacts to surface water.

3.3 SUBSURFACE SOILS

Action levels for volatile organic compounds (VOC) in subsurface soils were developed to be protective of groundwater and, ultimately, surface water. Metals and rads were not included because they are not generally mobile in groundwater. The level of soil contamination protective of groundwater was determined using a soil/water partitioning equation and a calculated dilution factor (EPA, Draft Soil Screening Guidance, 1994). The partitioning equation used chemical-specific parameters and site-specific subsurface media characteristics to determine the equilibrium partitioning of a given contaminant between the soil and groundwater. The dilution factor accounts for dilution up to the edge of the source location. Using this approach, soil contaminant levels that would be protective of groundwater to 100 x MCLs were calculated (see Appendix C).

A two-tier approach to soil action levels was developed. Tier-I addresses all subsurface soils capable of leaching VOCs to groundwater at concentrations greater than or equal to 100 x MCLs. Tier-II action levels for subsurface soils are protective of human exposure on the basis of the construction-worker exposure scenario.

4.0 GROUNDWATER PLUMES AND REMEDIATION

4.1 IDENTIFICATION

The VOC groundwater plumes at RFETS have been defined on the basis of exceedances above the MCL for individual constituents (see Figure 4-1). To delineate areas of highly contaminated groundwater, the proposed groundwater cleanup standards of 100 x MCLs were compared against all groundwater data for the most common VOCs in groundwater and the exceedances were plotted (see Figure 4-2).

Seven principal groups of groundwater plumes have been identified based on the existing monitoring well data: (1) 119.1 Groundwater plume, (2) Mound groundwater plume, (3) 903 Pad Hillside Plume, (4) 118.1 Plume, (5) East Trenches Area Plumes, (6) IA Plumes, and (7) Additional Plumes. Other low-level plumes that may exist were not considered in the following conceptual discussion of remedial actions.

4.2 GROUNDWATER REMEDIATION

4.2.1 Assumptions

The proposed remedial actions are conceptual in nature. No engineering feasibility analysis has been performed for any of the actions proposed herein. The intent of this Strategic Plan is to provide a generalized solution based on current site conditions, the proposed regulatory framework, and the Vision. At this time, it is recognized that the Vision is subject to interpretation; complete concurrence regarding the regulatory framework has not yet been reached. Also, the effectiveness of the proposed remedial actions has not yet been evaluated with regard to changing site conditions over time. To be consistent with the Vision, it is necessary to select effective remedial actions that will require minimal plant infrastructure for maintenance and operation. Therefore, the proposed remedial actions show a bias towards passive groundwater treatment or containment.

The proposed conceptual groundwater remedial actions were developed using the following assumptions:

- Source removals or containment will be done for subsurface soil sources to be protective of groundwater concentrations at 100 x MCLs.

- Remediation and plume management will be done to preserve wetlands where possible, and will be implemented using cost-effective methodologies.

- The remediation and management decisions described herein are based on the existing data set for groundwater plumes as well as on known technologies that are currently believed to be applicable.

- Where remedial actions are necessary, passive treatment or containment devices will be sited at a downgradient location coincident with the 100 x MCL boundary within the plume.

- An alternatives analysis for any proposed remedial action will be presented as an Interim Measure/Interim Remedial Action (IM/IRA) decision document or Proposed Action Memorandum (PAM).

4.2.2 119.1 GROUNDWATER PLUME

The 119.1 area within OU 1 is the site of historic releases of chlorinated solvents to the environment. The released solvents have contaminated shallow groundwater and have formed a plume extending down the 881 Hillside. In 1992, a French Drain designed to intercept contaminated groundwater flowing down the 881 Hillside was installed. A three-foot-diameter recovery well, located within the source area, were also installed to recover water containing high levels of dissolved solvents. A removal action is currently planned to treat those soils containing solvent concentrations greater than the Tier-I action levels.

RFETS groundwater will not be used directly for domestic or other consumptive purposes, but groundwater containing low levels of trichloroethene, tetrachloroethene, 1,1-dichloroethene, and carbon tetrachloride currently reaches a spring above Woman Creek. However, the French-Drain system intercepts the upgradient contaminated groundwater, so concentrations of chlorinated solvents reaching surface water should decrease through time.

The proposed remedial action for groundwater primarily consists of source removal. Because most of saturated soils containing groundwater contaminated above the 100 x MCLs would be excavated, the 881 French Drain and recovery wells would be removed from operation after the excavation is complete and upon demonstration that the proposed remedy has been effective.

There are no direct pathways to human receptors, so this action will not reduce long-term human-health risk. However, this action should reduce the long-term stress to environmental receptors of contaminants that may reach Woman Creek.

4.2.3 MOUND GROUNDWATER PLUME

The Mound groundwater plume is located in OU 2 east of the Protected Area (PA) security fence, along the south bank of South Walnut Creek below the Mound sites. This plume is poorly defined but is suspected to migrate northward from the Mound area and discharge to South Walnut Creek near the sewage treatment plant. The plume is associated with colluvial and alluvial materials near seep SW059. Contaminated seepage water at station SW059 is collected and stored for treatment at the Building 891 Treatment Facility. Dense nonaqueous phase liquids (DNAPLs) eminating from the Mound area are suspected to be the source of groundwater contamination in this area.

RFETS groundwater will not be used directly for domestic or other consumptive purposes, but groundwater from the plume containing vinyl chloride, tetrachloroethene, and trichloroethene has reached South Walnut Creek and is discharging through surface and subsurface seepage. The potential exists for these concentrations to increase over time.

To remediate the Mound plume, sources exceeding Tier-I action level for soil cleanup criteria for VOCs would be removed from the Mound area. Groundwater with concentrations of VOCs in excess of 100 x MCLs would be collected through improvements to the existing collection system and treated by a system to be installed along the south bank of South Walnut Creek to prevent discharge of contaminated groundwater to surface water. Active groundwater collection and treatment systems are considered infeasible for this area because of low hydraulic conductivities, limited saturated thicknesses, and complex interaction of groundwater between colluvial and bedrock units. Monitoring of groundwater downgradient of the treatment system and downgradient of the facility for plume constituents would be conducted to demonstrate system performance.

Discharge of contaminated groundwater to South Walnut Creek represents a potential risk to the environment. Containment and treatment of the Mound groundwater plume will result in a reduction of risk to the environment posed by uncontrolled of contaminated groundwater releases to surface water.

4.2.4 903 PAD HILLSIDE GROUNDWATER PLUMES

The 903 Pad hillside groundwater plumes are located in the Woman Creek drainage below the 903 Pad and Ryan's Pit areas and north of Pond C-1. These plumes occupy the southeast corner of the IA and associated east buffer zone.

The groundwater in this area is contaminated with carbon tetrachloride, tetrachloroethene, trichloroethene and other VOCs. This contaminated groundwater exists in alluvial, colluvial and relatively low-permeability bedrock sandstone units (Laramie Formation) and forms a complex plume (or plumes group) that flows toward Woman Creek. The highest concentrations of VOCs in groundwater are associated with the 903 Pad and Ryan's Pit although isolated "hot spots" have been observed within the body of the plume away from these sources. DNAPLs are known to have existed at Ryan's Pit and are also presumed to exist at the 903 Pad.

Groundwater flow paths in alluvial materials at the 903 Pad are relatively well-defined by contact seeps with the underlying bedrock materials and numerous wells. By comparison, the hydrogeology of hillside colluvium and bedrock groundwater flow is, at best, only poorly understood. Areas of unsaturated colluvium are fairly common and prediction of flow paths can be difficult. Discharge of contaminated groundwater to surface water has not been observed from this plume

Groundwater will not be used directly for domestic or other consumptive purposes, but there are potential ecological impacts related to surface water. Water from the plume containing tetrachloroethene and trichloroethene may, with time, enter the South Interceptor Ditch and Woman Creek. Contaminated groundwater may reach these surface-water pathways if no actions are taken to capture and remediate the plume front. Discharge of contaminated groundwater to Woman Creek represents a potential risk to the environment. Capture and treatment of the 903 Pad Hillside groundwater plume front will result in a reduction of risk to the environment posed by uncontrolled releases to surface water.

In the proposed remedy, contaminant sources exceeding applicable RFETS soil cleanup criteria for VOCs would be removed from the 903. Groundwater remediation would involve a plume capture and treatment system installed at the plume front boundary defined by 100 x MCL. Monitoring of treated groundwater and groundwater downgradient of the collection facilities for plume constituents would be conducted to ensure system performance. Active groundwater collection and treatment systems are considered infeasible for this area because of low hydraulic conductivities, limited saturated thicknesses, limited area extent of saturated zones, and complex interaction of groundwater between colluvial and bedrock units.

4.2.5 118.1 GROUNDWATER PLUME

Adjacent to the OU 4 (Solar Ponds) is IHSS 118.1, a site where IA activities resulted in a release of chlorinated solvents. The released solvents have contaminated UHSU groundwater and have

formed a plume which may reach the North Walnut Creek drainage. An Interceptor Trench System (ITS) was installed to intercept contaminants and capture the plume. Source removal actions currently are planned to recover free liquid DNAPL where feasible and to potentially remove contaminated soils where feasible. Discussion concerning nitrate contamination is addressed in Section 4.2.8, Additional Plumes.

Although RFETS groundwater will not be used directly for domestic or other consumptive purposes, there is some potential for adverse ecological impacts in surface water. Groundwater containing trichloroethene, tetrachloroethene, vinyl chloride, and carbon tetrachloride may currently reach North Walnut Creek. The ITS captures 2.7 million gallons of water per year, but is not entirely effective, enabling some contaminants to enter the North Walnut Creek drainage.

Proposed groundwater remediactions include source removals for VOCs, after which the operation of the ITS would be discontinued. A potential remedy is placement of a slurry wall is planned for installation around the groundwater plume at the 100 x MCLs concentration boundary, for the purpose of containment. According to the Vision (see Fig. 1-1, Area 0), the perimeter of such a slurry wall would be overlain by a 130-acre cap. The cap will be designed to minimize infiltration and prevent the build-up of excessive head within the containment structure.

There are no direct pathways to human receptors, and this proposed action will not reduce the risk to human health; however, this action should reduce the stress to environmental receptors from contaminants reaching North Walnut Creek.

4.2.6 GROUNDWATER PLUMES IN THE EAST TRENCHES AREA

Groundwater contaminant plumes in the OU 2 East Trenches area are located in the east buffer zone at IHSSs 111.1 and 110 to the south, Ponds B-1 and B-2 to the north, and along the east access road. Here, groundwater contaminated with carbon tetrachloride, tetrachloroethene, trichloroethene and other VOCs exists in alluvial and permeable sandstone bedrock units (Arapahoe No. 1 sandstone) and forms two plumes in the OU 2 East Trenches area of RFETS. The bedrock sandstone unit subcrops in the South Walnut Creek drainage.

The northern boundary of the bedrock plume extends to a spring and seep complex located on the south bank of South Walnut Creek, above Ponds B-1 and B-2. Concentrations of VOCs above 100 x MCLs have been detected by a recent sampling program conducted at the seep complex. Potential source areas for the groundwater plume in the East Trenches area bedrock include IHSSs 111.1 and 110, as well as leakage of groundwater contaminated with VOCs from overlying alluvial deposits in areas south of the trenches (traffic triangle).

Alluvial groundwater contaminated with VOCs occupies a narrow, incised bedrock channel that approximately parallels the east access road. Lateral spreading of this plume is observed where alluvial groundwater exits the channel near the northern end of the south spray field area. Alluvial groundwater discharges to surface water as seeps in an unnamed tributary drainage to South Walnut Creek. DNAPLs are presumed to exist at the source areas in both the saturated and unsaturated zones of the overlying alluvium.

Although groundwater will not be used directly for domestic or other consumptive purposes, there are potential ecological impacts related to surface water. Water from the plume containing tetrachloroethene and trichloroethene has reached South Walnut Creek. The potential exists for concentrations in these seeps to increase over time and contribute a greater contaminant mass to surface water.

Sources exceeding applicable RFETS soil cleanup criteria for the Tier-I action level for VOCs would be removed, where feasible, from the East Trenches area. Potential groundwater remediation would involve a combination of plume capture and passive treatment technologies installed at plume front boundaries. Monitoring of treated groundwater and groundwater downgradient of the facilities for plume constituents would be conducted to ensure system performance. Groundwater treatment and system maintenance would likely be required for many decades.

Discharge of contaminated groundwater to South Walnut Creek represents a potential risk to the environment and rapidly spreads contaminants to downstream areas. Capture and treatment of the contaminant plume in the OU 2 East Trenches area will result in a reduction of risk to the environment posed by contaminant migration to the surface water system.

4.2.7 IA GROUNDWATER PLUME

The IA contains a coalesced plume of trichloroethene thought to emanate from IHSSs 117.1, 117.2, 157.1, 158, and 171; tetrachloroethene thought to emanate from IHSSs 117.1, 117.2, 158, 157.1, 160, and 171; and carbon tetrachloride thought to emanate from IHSSs 117.1, 117.2, and 158. This coalesced plume lies within the southwestern quadrant of the IA.

Although RFETS groundwater will not be used directly for domestic or other consumptive purposes, the potential ecological impacts may be expressed in surface water. Currently, the groundwater plumes appear stable and are not impinging any surface-water body. The ongoing groundwater monitoring program collects samples from wells inside and outside of the plume.

Analysis of these groundwater samples will show any movement, expansion, or attenuation of the plume.

The proposed remedial actions would include removal of soils containing contamination above the Tier-I action level where feasible, eventual cut-off of man-made recharge from water supply lines and sewers, installation of a soil vegetative cover and/or regrading over the IA to limit natural recharge and contaminant leaching, and monitoring of groundwater plumes. Groundwater recharge in the IA caused by water losses from sewers and water supply pipelines is estimated from water budget studies made for the OU 5 RI/RFI investigation and by the Surface Water Division to be between 7 and 26 million gallons per year, respectively.

Under consideration are alternative remedial actions such as diverting groundwater flow upgradient of the IA and collecting contaminated groundwater within the IA by linking footing drains on selected buildings with new sections of horizontal drains connected to the existing treatment facility in Building 891. Preliminary calculations indicate that only 15 percent of the present recharge (precipitation plus groundwater influx) to IA could be diverted by a upgradient barrier. If the upgradient barrier diverts only 3.6 gallons per minute of groundwater flux from entering the IA, then there appears to be little actual benefit to justify the significant cost for materials and installation. The collection of contaminated groundwater within the IA does not appear to be necessary to achieve the Vision (see Appendix B) or the cleanup goals (Appendix C). However, groundwater collection may be necessary if the hydraulic conditions change causing mobilization of the plumes.

There are no complete pathways to human receptors, and none of the actions will reduce human-health risk. Contaminated groundwater is not currently reaching surface water, but there is some potential for ecological risk in the future.

4.2.8 ADDITIONAL PLUMES

Landfill Plume

Additional groundwater plumes are located south and west of the current landfill pond, including a portion of OU 7. Aluminum, manganese, zinc, 2-methylnaphthalene, naphthalene, benzene, and possibly methylene chloride are present downgradient of the current landfill, with average values exceeding MCLs. Although RFETS groundwater will not be used for drinking water or other consumptive purposes, and there is no complete groundwater pathway to reach human receptors, contaminants above MCLs will reach surface water without remedial action.

An interim remedial action currently under construction will include the installation of a gravity flow system designed to intercept the contaminated groundwater and leachate flowing from the landfill for purpose of treatment. This system will consist of cement vaults receiving contaminated water through a gravity-driven system. Treatment will include a settling basin, bag filter to remove additional suspended solids, and granular activated carbon to remove organic chemical constituents. Modifications to this design may be required if long-term treatment is determined to be necessary.

There are no complete pathways for contaminated water to reach human receptors directly, and consequently there would be no reduction in human-health risk achieved by implementing these remedial actions. Contaminated water would be treated to nondetect levels and this treatment should effectively mitigate the potential ecological risk from the contaminants of concern.

Solar Ponds Nitrate Groundwater Plume

The Solar Ponds area of OU 4 is a historic release site to the environment of nitrates. The released nitrates have contaminated UHSU groundwater which forms a plume that extends from the Solar Ponds area northward to the Walnut Creek drainage above Pond A-1. Two ITSs were installed to intercept contaminants and capture the plume. No source removal is planned for nitrate-containing media.

Although RFETS groundwater will not be used directly for domestic or other consumption, there is some potential for adverse ecological impacts in surface water. Groundwater containing elevated nitrate concentrations is known to exist in wells located along North Walnut Creek. The ITS captures 2.7 million gallons of water per year, but is not entirely effective in preventing the spread of nitrate contamination to the North Walnut Creek drainage.

Proposed remedial actions for groundwater nitrate, if required, will be developed at a later date based on final cleanup standards and site-specific hydrogeologic conditions. There are no direct pathways to human receptors, and any proposed action will not reduce the risk to human health; however, proposed actions may reduce the risk to environmental receptors.

4.3 PLUME RANKING

The groundwater plumes were ranked in accordance with the method outlined in the "Environmental Restoration Ranking" (September 1995). Briefly, all available data for VOC concentrations in groundwater were compared to the proposed cleanup levels of 100 x MCLs,

then the ratios of the exceedances (i.e., concentration/MCL) were used to delineate the plumes. The maximum ratio for each analyte per plume was tabulated and a total score for each groundwater plume was calculated by adding maximum ratios. Only the highest ratio was used for each chemical per plume.

Because several of the ratios were very large, using these ratios directly would bias the ranking results; therefore, the total scores were converted to bring the 100 x MCLs scores in line with the multipliers used to factor in mobility and potential for further release (see Table 4-1).

Table 4-1 Conversion Table for Scores

Total Groundwater Score	100 x MCL Score
> 501	10
251 – 500	9
101 – 250	8
76 – 100	7
51 – 75	6
31 – 50	5
21 – 30	4
11 – 20	3
6 – 10	2
1 – 5	1

The multipliers for mobility and the potential for further release (see Table 4-2) were taken directly from the Environmental Restoration Ranking. The mobility multiplier takes into account the mobility of chemicals in the environment and the proximity of the contaminant plume to surface water, which could potentially transport the contaminants offsite. The potential for further release rates the potential for contaminants to continue leaking into the groundwater environment and includes cross-media movement of contaminants within the environment.

The total ranking score was calculated by multiplying the 100 x MCLs score by the multipliers for mobility and potential for further release. The plume ranking is shown in Table 4-2.

To avoid having more than one priority list of proposed environmental restoration actions at RFETS, the plume ranking in Table 4-2 will be incorporated into the previously developed IHSS

ranking. The new IHSS/plume priority list will rank sites based on whether the plume has a measurable impact on surface water, as well as on the criteria previously used for the Environmental Restoration Ranking.

Table 4-2 Plume Ranking

Rank	Plume Location	Total Groundwater Score	100 x MCL Score	Mobility Score Multiplier	Potential for Further Release Multiplier	Total Priority Score
1	903 Pad Hillside IHSS 109 Plume (002)	306.8	9	3	3	81
2	East Trenches Area IHSS 111.1 Plume (002)	254.4	9	3	3	81
3	903 Pad Hillside IHSS 112 Plume (002)	313.0	9	3	2	54
4	IHSS 118.1	53.2	6	3	3	54
5	Mound Plume (002)	187.9	8	3	2	48
6	East Trenches Area IHSS 110 Plume (002)	14.9	3	3	3	27
7	IHSS 119.1 Plume (OU 1)	87.9	7	2	1	14
8	Solar Ponds Nitrate Plume (004)	16.7	3	2	1	6
9	South IA Plume	11.9	3	1	1	3
10	Landfill Plume (007)	—	—	—	—	*

Note:
*No ranking values shown because the contaminant concentrations did not approach 100 x MCL.

5.0 GROUNDWATER MONITORING

The groundwater monitoring network will continue to operate as recently modified by the Groundwater Monitoring Working Group, unless subsequent changes are agreed to by all parties. Analyte suites, sampling frequency, and specific monitoring locations will be evaluated annually to adjust to changing hydrogeologic conditions such as plume migration and increased understanding of contaminant distributions. All groundwater monitoring data, as well as changes in hydrogeologic conditions and any exceedance of groundwater standards, will be reported quarterly and summarized annually to all parties.

All long term monitoring requirements for the Site, including those wells that are identified in the groundwater strategy, will be incorporated into the Groundwater Monitoring and Assessment Plan (GMAP). This document will incorporate two pre-existing plans: (1) the Groundwater Protection and Monitoring Program Plan (GPMPP) and (2) the Groundwater Assessment Plan (GWAP).

The GMAP will list the wells with their appropriate regulatory driver, the sampling frequency, and analyte suite as well as describe data evaluation and reporting methodologies. The GMAP will also reference other implementation plans and decision documents from which the requirements are derived. The GMAP will be updated regularly as programmatic changes occur.
If quarterly reporting shows that previously uncontaminated wells are contaminated above groundwater standards, the sampling frequency will be increased to monthly. Three consecutive monthly samples showing exceedances will trigger an evaluation to determine if a remedial or management action is necessary.

All groundwater remedies, as well as some soil remedies, will require groundwater performance monitoring. The amount, frequency, and location of any performance monitoring will be based on the type of remedy implemented and will be determined on a case-by-case basis within decision documents. The groundwater monitoring program will be integrated to the maximum extent practical.

6.0 CONCEPTUAL SCHEDULE

The previously ranked IHSSs and the ranking of groundwater plumes presented in Section 4.1 provide the basis for establishing the priority and sequence of remedial actions. The schedule for implementing groundwater remediation will be dependent on factors such as funding, data sufficiency, resource availability, and the integration with other remedial and site activities. The emphasis of the proposed near-future groundwater remedial actions will be on the removal of source material outside of the IA.

The following general schedule of activities is proposed:

1) Source Removal at IHSS 119.1, T-3, T-4, Mound
   Passive Groundwater Treatment at the Present Landfill

2) Source Removal at IHSS 118.1
   Groundwater Containment at 118.1
   Passive Groundwater Treatment at 903 Hillside

3) Remaining Source Removal Outside the IA
   Passive Groundwater Treatment at Mound and East Trench Area

4) Source Removal Inside the IA
   IA Cap

Before the construction phase of the cap begins, certain pre-construction activities must be completed. These activities will include, but are not limited to, additional investigations to help determine the optimal location of the cap, analysis of alternatives, and engineering design.

7.0 CONCLUSIONS AND SUMMARY

The specific goals of the Groundwater Strategic Plan are to provide a strategy consistent with the Vision and the Action-Level Framework for surface water, groundwater, and soils, to identify and describe the salient groundwater plumes, rank the groundwater plumes in accordance with the method outlined in the "Environmental Restoration Ranking" (September 1995), and provide an initial planning basis for work package development and funding.

To meet these goals, the strategy proposes source removal, where possible, provides for source control, where necessary and provides for the treatment of dissolve phase plumes, where necessary. The strategy includes an evaluation allowing some areas of contaminated groundwater to remain in place where the goals of the strategy can be met without active intervention.

Action levels for groundwater must be protective of surface standards and quality as well as the ecological resources. As stated in the draft Conceptual Vision, domestic use of groundwater at RFETS will be prevented through institutional controls. Since no other human exposure to groundwater is foreseen by the Vision, groundwater action levels are not based on human health protection. The protectiveness of surface water will be achieved by applying MCLs as groundwater standards. A two-tier approach to groundwater remediation and monitoring is being proposed.

The following proposed conceptual actions would be the direct result of applying the action levels for groundwater remediation within the framework of the Vision:

- Contaminated soils in OU 1 (IHSS 119.1) above action levels would be excavated, thereby removing material above the Tier-I Action Level. Since the source of groundwater contamination would be removed, the use of the French Drain system and recovery well eventually would no longer be necessary. Monitoring will demonstrate the effectiveness of the remedy.

- In OU 2, sources exceeding Tier-I Action Levels will be removed to the extent practical. Contaminated groundwater will be collected by systems installed on the hillsides. Groundwater would be directed to a treatment system. The capture structures would be located approximately at the 100 x MCL boundary on the down gradient side of the plume where surface water is determined to be potentially at risk.

- Known areas of carbon tetrachloride sources would be evaluated for potential excavation near IHSS 118.1 where feasible. The ITS currently located down gradient of the Solar

Ponds would be removed from service. An impermeable barrier may be installed to contain the portion of the chlorinated solvent plume that exceeds the 100 x MCL contaminant concentration in groundwater

- A gravity flow treatment system will be installed to treat leachate and contaminated groundwater flowing from the present Landfill. However, the current system is designed as an interim measure. Modifications may be required for long term use.

- A soil vegetative cover and regrading would be used over portions of the IA to limit natural recharge caused by precipitation from leaching of contaminants in the unsaturated zone. This approach is predicted to reduce the movement of groundwater through the IA and thereby reduce the mobility of the plumes. Subsurface sources of groundwater contamination would be removed where practical. At the end of the D&D/remediation phase, the plant water supply and plumbing systems would be shut off. This would eliminate the major source of groundwater recharge for the IA and should greatly reduce the mobility of plumes originating from the IA.

Further analysis is required to determine optional intercept locations, actual treatment methodologies and cost-effective project sequencing.

Appendix A

Acronym List

CDPHE	Colorado Department of Public Health and Environment
D&D	Decontamination and Decommissioning
DNAPL	Dense Nonaqueous Phase Liquid
DOE/RFFO	Department of Energy/Rocky Flats Field Office
EPA	Environmental Protection Agency
GMAP	Groundwater Monitoring and Assessment Plan
GPMPP	Groundwater Protection and Monitoring Program Plan
GWAP	Ground Water Assessment Plan
IA	Industrial Area
IHSS	Individual Hazardous Substance Site
IM/IRA	Interim Measure/Interim Remedial Action
KH	Kaiser-Hill
LHSU	Lower Hydrostratigraphic Unit
MCL	Maximum Contaminant Level
OU	Operable Unit
PAM	Proposed Action Memorandum
RFETS	Rocky Flats Environmental Technology Site
RMRS	Rocky Mountain Remediation Services, L.L.C.
SNM	Special Nuclear Material
TRU	transuranic
UHSU	Upper Hydrostratigraphic Unit
VOC	Volatile Organic Compound
WQCC	Water Quality Control Commission

Appendix B

Draft Site Vision

Clean It Up and Make It Safe

The Rocky Flats Conceptual Vision – A Focus for Action

I. INTRODUCTION

The Principals have agreed to the following draft conceptual Vision (hereinafter referred to as "Vision") which will be used to help guide the future direction of the Rocky Flats Environmental Technology Site (Site). The Vision focuses on all actions at the Site including cleanup, plutonium consolidation, safety, physical plant conversion and land use. There are two phases of the Vision hereinafter the term "Vision" will refer to both this intermediate and final site conditions unless specific reference Is made to the Intermediate or final site condition):

- Intermediate Site Condition: This phase describes the Site's condition at the completion of all major environmental remediation, decontamination and decommissioning and all other DOE activities – except removal of the remaining special nuclear materials (mostly plutonium and containerized waste storage in buildings onsite. During the intermediate phase, as discussed in detail below, most of the buildings will have been demolished, and Plutonium and some wastes will be stored on site.

- Final Site Condition: This phase describes the Site's condition after removal of ail stored special nuclear materials and containerized wastes and completion of all DOE activities – except those related to the long-term care and maintenance of waste that may remain at the site in landfills.

A premise underlying the final Vision is that all stored plutonium and other special nuclear materials will have been removed from the Site by the target date of the year 2015. In addition, no DOE-operated building will remain at the Site. The only buildings that may remain will have been converted to new Industrial activities operated and supported by others. Fundamentally, the Vision contemplates that, in a much shorter time frame than has previously been planned, DOE will clean up the Site consistent with the future projected land and water uses and will make the Site safe first by stabilizing and consolidating and then by removing plutonium. Finally, the Vision does not preclude further waste treatment or removal of waste in the event that conditions change significantly.

The Vision provides for the division of the Site into five areas, as reflected in the attached map (more detailed discussion of the five areas delineated on the map is included In section V. Final Site Condition below). The major difference between the Intermediate Site Condition and the

Final Site Condition is that there may still be plutonium and transuranic wastes stored at the Site during the Intermediate Site Condition.

By focusing DOE's and its regulators' efforts properly, the Site can achieve sound safety and environmental results sooner than previous projections, even in this era of limited government resources. And, by obtaining community agreement on a Vision, the parties will be able to move towards its achievement more quickly.

II. KEY ASSUMPTIONS

The principals have developed this Vision with the acknowledgment of some guiding assumptions. These assumptions are based on a recognition of the fiscal constraints and political difficulties In dealing with the types of wastes, materials and issues at the site. These assumptions also acknowledge the public input received to date regarding the future of the Site (see, for example, the future Site Use Working Group and the fuller description of efforts consulted In Section VI. Resources below). Specifically, the key assumptions that underlie this Vision of a safe and remediated Site are as follows;

(1) Plutonium and other Special Nuclear Materials (SNM) that now exist on Site

* The Principals agree that, since no alternative storage or disposal site for SNM presently exists, DOE must store the SNM onsite safely until an alternative location becomes available. DOE will not transfer onto the Site any additional plutonium. Our goal is to remove the plutonium and SNM no later than 2015.

(2) All Wastes (except SNM)

* Since there are substantial costs and risks inherent in moving all waste now stored onsite and those wastes that will be generated during plutonium stabilization, cleanup and building decommissioning, DOE, together with the regulators and with appropriate public participation, will decide how to divide the wastes between those that go on- and offsite through an ongoing process that is consistent with the precepts set forth in this Vision.

* Waste that remains onsite will be managed safely and, if future technology and finances permit, may be retrieved and removed at a later date. DOE will not

import substantial[1] quantities of waste onto the Site either for treatment or disposal.

(3) land Use and Cleanup Standards

* Recognizing the financial and technical limitations in returning the Site to a pristine condition, the Principals endorse the selection of cleanup standards that will achieve reasonably anticipated land and water uses.

III. SUMMARY OF CLEANUP STRATEGY TO ACHIEVE THE VISION

The intermediate and final site conditions (see Section IV. and V. below) describe the general condition of the Site at those stages In the implementation of the Vision. This Section summarizes the underlying principles that will be followed during the cleanup of the Site to reach the final site condition. Specifically, as the cleanup occurs, the Vision is premised on the following elements:

- The recognition of community preferences for land use at the site
- The logic that cleanup standards will protect reasonably foreseeable future land and water uses
- The practical consideration that some contamination will remain at the Site
- The recognition that soil, surface water, groundwater, and building cleanup needs are interrelated

With regard to the specific cleanup strategies, the Principals agree to the following:

1. Land use and soil cleanup. Soil cleanup will make the land safe for industrial use and open space (in Area 1 – 4 on the attached map), and will protect groundwater and surface water Soil remediation strategies will include such things as soil removal, soil treatment and soil consolidation.

[1] Very small quantities (a few drums) of waste may be imported from other sites in unusual circumstances. For Rocky Flats plans to accept the return of less than one drum of Rocky Flats waste previously shipped to Savannah River.

2. Groundwater use and cleanup standards. around water cleanup will protect surface water. Groundwater management and remediation strategies will include such things as source removal, treatment, containment, and hydrologic gradient management. No use of onsite groundwater will be allowed so as to protect the hydrologic gradients (to minimize horizontal and vertical migration of contaminants) and to preserve the open space character of the land. Nevertheless, groundwater quality offsite and in Area 3 will be protective for all uses.

3. Surface water use and cleanup standards. Similarly, surface water cleanup will protect the specified uses of the surface water. This includes being protective of the ecology in Area 2. In Area 3 and offsite, surface water will be protective of all uses. (As a factual matter, surface water down-stream from the site is being diverted around the public water supply reservoirs so that surface water crossing the Site will not affect domestic water supplies. Accordingly, the surfaces water crossing the Site could be reclassified for aquatic and recreational uses, and not for water supply.)

4. Decision Criteria. DOE will eliminate, treat, consolidate, contain and manage contaminated soils, water and materials in a manner that reduces the impact to natural resources and that protects and supports reasonably anticipated future land and water uses. A combination of factors Including technical feasibility, cost, worker safety (risk of doing cleanup), risk reduction, Opportunity for offsite disposal, future land use and effectiveness will form the basis for determining which wastes remain onsite.

5. Other considerations. In general, cleanup levels for soil, groundwater surface water and buildings will also be designed to minimize vertical and horizontal migration of contamination. Because some waste will remain onsite in Area 0, and there may be residual contamination in Areas 1, 2, and 4, long-term care for the Site will be required. As a result, the issue of long-term ownership of the Site remains unresolved.

IV. INTERMEDIATE SITE CONDITION

As noted above, this Vision is based on the completion of two phases: an Intermediate site condition and a final site condition. The Principals agree to the following description of the intermediate phase of site condition:

- Safe stable storage will be created for plutonium and containerized waste. Plutonium includes all accountable special nuclear materials and building holdup (such as plutonium that is removed from ventilation ducts) removed from the buildings. The plutonium will be in a form to accommodate the earliest possible shipment from the Site. Containerized

waste includes transuranic, and transuranic mixed wages removed from buildings. This storage will be in safe configuration and will be technically and economically viable for long-term storage, if necessary.

- Most buildings, except those needed to store plutonium and containerized wastes and those with clear, alternative economic value and use, will be demolished and/or covered.

- To the extent possible, there will be no visible reminder of the Site's past, except that two buildings will remain for plutonium and waste storage.

- Major environmental cleanup activities will be complete except in those areas unavailable because of on-going storage. (When the storage mission is complete, DOE will then complete any environmental cleanup remaining in those areas.)

- There will be minimal infrastructure left in place at the Site.

- The projected working population associated with DOE activities will drop to less than 500 from the current figure of more than 5000.

- The annual operating cost should be less than $60 million, down from more than $600 million today.

V. FINAL SITE CONDITION

The final site condition is characterized by five areas as delineated in the attached map. The Principals agree to the following components for each of the five areas:

AREA 0: LANDFILLS (INCLUDING PROTECTED AREA CAP)

- There will be three or four capped areas left on Site: one or both of the existing landfills, the 800 area and what is now the Unprotected area to the north of Central Avenue.

- There will be onsite, long-term disposal of some wastes in an area potentially covering 100 acres in the "protected area." DOE will consolidate all wastes left on site in landfills or in the existing Industrial Area. DOE will cap the landfills and there will be no use of ground or surface water for any purpose in Area 0. DOE will divert storm water runoff consistent with normal storm water management standards and will monitor and control groundwater to prevent migration and preserve the integrity of the landfills. Ongoing maintenance of ground and surface water control system will continue as necessary.

- The landfills will be capped using a low profile designed to blend in with the topography. these landfills may contain low level, low level mixed, hazardous or solid wastes In the form of demolition debris and cleanup waste, as well as process wastes if required.

- Below the caps in the 800 and protected areas, there will be three types of material: cleanup or other waste contained within a waste disposal cell, residual contaminated soils or materials (for example, buried pipes) left in place, and buildings, either alone or with waste inside.

- DOE will have removed all transuranic and transuranic mixed waste to a safe, onsite storage facility until they can be shipped offsite.

- Low level and low-level mixed waste standards will apply to cleaning the buildings and equipment prior to their demolition or covering; thus, low level mixed waste will be removed from a building before its demolition unless the building meets appropriate waste isolation performance criteria. Methods chosen for demolishing and disposing of buildings will be protective of human health and the environment. Low level and low-level mixed waste generated as a result of cleanup and decontamination activities will be disposed of in a specific cell or in buildings belong covered under the cap. The current onsite Inventory of low level and low level mixed waste (except pondcrete) will be removed from the buildings and disposed of on- or offsite, subject to public input, cost-benefit analysis, and other considerations.

AREA 1: POTENTIAL INDUSTRIAL USE (CURRENT INDUSTRIAL AREA)

- Land in Area 1 will be available for future industrial use. DOE will clean up Area 1 to levels protective of surface water and reasonably expected human exposure in an industrial setting. There will be no surface or groundwater used for any purpose. In addition, similar to Area 0, DOE will divert or otherwise control storm water as required by best management practices. DOE will monitor and control groundwater to minimize horizontal and vertical migration of contaminants so as to protect land and water uses.

AREA 2: OPEN SPACE (INNER BUFFER ZONE)

- Land use in Area 2 will be open space. Use of surface water will be for ecologic purposes. (While these uses are less restrictive than the existing water supply classification, the Principals recognize that the Site's surface waters are now being diverted around

public water supplies and are therefore, not a water supply.) There will be no groundwater use for any purpose.

- The standards to govern cleanup in Area 2 will be selected to protect surface water, the ecosystem, and reasonably expected human exposure in an open space setting. These cleanup levels will support open space use; however, access may be limited based on policy considerations This Area is bounded on the North and South by Walnut and Woman Creeks, respectively. These Creeks bound the contaminated areas and form hydrologic barriers to contaminant migration. Several of the existing ponds in the Creeks (with or without the earthen dams) may remain to enhance and preserve ecologic values, but no ponds will remain as part of the Site's wastewater treatment system.

AREA 3: OPEN SPACE (OUTER BUFFER ZONE)

- Land use in Area 3 will be open space. This area is uncontaminated so no cleanup is necessary. DOE mission activities did not affect much of this acreage. Both the surface water (in the Creeks) and the groundwater quality could support any uses. However, open space use limits access to water, and no groundwater pumping in Area 3 will be allowed that could affect contaminant migration in Areas 0, 1 or 2.

AREA 4: OPEN SPACE (RESIDUAL PLUTONIUM SOIL CONTAMINATION)

- The land use in Area 4 will be open space. Residential use is not and this Area will not now support residential use due to plutonium contamination of surface soils. The quality of the surface water in the Creeks that bound this area will support unrestricted use; the around water quality will also support any future use. The decision to clean this area up, and the selection of soil cleanup standards, will be made depending on technology, ecologic risk or damage, worker risk, potential for re-mobilization of plutonium In the air. Soil or water, and the availability of a suitable disposal facility.

VI. RESOURCES

The preceding proposed Vision for the Rocky Flats Environmental Technology Site is a compilation and merger of several past and current efforts including:

- March 1995 Stakeholder Summit

- The Rocky Flats Local Impacts Initiative's Future Site Use Working Group product, "Future Use Recommendations For the Rocky Flats Environmental Technology Site

- The Quality Action Team (QAT) document, RFETS Objectives for the Year 2000
- The QAT recommendation In the Sept. 11, 1995 "RFCA Issues Briefing Document
- RFFO's working draft describing future use options for RFETS, Draft Future Use Vision Document
- 9/30/95 draft "Accelerated Site Action Project" (ASAP) for RFETS
- Discussion and agreement during the Work Out Session held October 10 – 11, 1995 by RFFO, DOE Headquarters, Colorado's Lt. Governor, CDPHE, EPA and EPA Region VIII.

Appendix C

Draft Action-Level Framework for Surface Water, Groundwater, and Soils

Rocky Flats Environmental Technology Site

Action-Level Framework for Surface Water, Ground Water, and Soils

Table of Contents

43

1.0 GENERAL BACKGROUND

1.1 GOAL OF ACTION-LEVEL FRAMEWORK AT RFETS

On October 10 and 11, 1995, a "Workout Session" was convened between DOE, EPA, CDPHE, DNFSB, and Kaiser-Hill to resolve, or develop a path to resolve, all outstanding issues associated with the new Rocky Flats Cleanup Agreement (RFCA). Several of the significant Workout Session outcomes include agreement on a conceptual vision of the end-state of RFETS after closure and cleanup, and agreement that the environmental cleanup of the site will now be implemented through a "carve-out" approach. The conceptual vision designated the approximate areal extent of four future land uses. These include capped areas underlain by either waste disposal cells or contaminated materials closed in-place, an industrial area, an inner buffer zone managed as open space, and an uncontaminated outer buffer zone that, while it will be managed as open space, actually could be used for any use. The carve-out will be implemented such that EPA will be the lead regulatory agency over the buffer zone, and CDPHE will be the lead regulatory agency over the industrial area. Additional clarification of the CDPHE and EPA roles will be defined in an EPA/CDPHE Memorandum of Agreement, expected to be finalized in January, 1996.

As a result of the Workout Session, a working group was formed to develop a consensus position on the appropriate cleanup standards that should apply to RFETS. This Action-Level Framework presents the final product of the working group. It has been developed in a manner generally consistent with the conceptual vision and carve-out. In some cases, the working group found it necessary to more precisely define aspects of the conceptual vision so that applicability of action levels and required mitigating actions could be completely defined. The goal of the Action-Level Framework is to:

a. provide a basis for future decision-making,

b. define the common expectations of all parties, and

c. incorporate land- and water-use controls into site cleanup.

The working group consisted of DOE, EPA, CDPHE, and Kaiser-Hill staff. This document represents a consensus of these parties.

1.2 PROGRAMMATIC ASSUMPTIONS

The working group developed this framework using the following inter-related programmatic or site-wide assumptions:

1. The framework must be consistent with the Conceptual Vision.

2. Implementation of the framework must protect human health and the environment.

3. Implementation of the framework must protect surface water uses and quality.

1.3 OUTSIDE FACTORS

The working group recognizes that there are several factors outside of our control. Foremost among these factors is the Water Quality Control Commission (WQCC). The WQCC determines water quality standards throughout Colorado. The consensus position presented herein delineates several changes to existing use designations and standards for water at RFETS. There is no guarantee that the WQCC will make the changes this document recommends.

Another factor that could affect the positions presented in this document is public response to the conceptual vision, other Workout Session issue resolutions, and these action levels. Specifically, the response of the down-stream municipalities, including Westminster, Broomfield, Thornton, and Northglenn, will be extremely important in finalizing these standards and action levels.

2.0 SURFACE WATER (12/7/95)

2.1 BASIS FOR STANDARD

Some of the surface water quality standards proposed herein differ from the existing water quality standards. These will necessitate a review and change by the Water Quality Control Commission (WQCC). CDPHE agrees to jointly approach the WQCC with DOE and Kaiser-Hill to accomplish these changes. Modification requests for the surface water quality standards must provide sufficient rationale and justification to document that all existing and potential uses will be protected.

Once the changes to the standards have been made, the new standards promulgated by the Water Quality Control Commission (WQCC) will be applied to the surface water at RFETS. In addition,

points of compliance have been determined to measure water quality and compliance ramifications are delineated. This is consistent with the Conceptual Vision.

Surface water exists in Areas 2, 3 and 4 of the Vision, as well as immediately off-site. The standards and points of compliance presented below are based on the following "fine-tuning" of the Vision-delineated areas (this assumes no changes to current pond "plumbing" configurations):

A. Area 2 will include all surface water down to, and including, the terminal ponds (Ponds A-4 and B-5) in Walnut Creek. For Woman Creek, only Pond C-2 is in Area 2.

B. Areas 3 and 4 will include the streams from the terminal ponds to the plant boundary in Walnut Creek and all of Woman Creek except Pond C-2.

2.2 STANDARDS

2.2.1 Vision Areas 3 and 4 - Big Dry Creek Segment 4

A. Non-radionuclides

1. The standards that apply throughout this stream segment are based on current and potential surface water uses consistent with the Vision's goal of protecting all uses:

   Aquatic Life - Warm 2
   Recreation 2
   Agricultural
   Domestic Use

2. The numerical standards associated with each of these use classifications are included in Table 2-1.

[DOE and Kaiser-Hill do not support including the Domestic Use classification for Segment 4, particularly after Option B is completely in place. This raises questions as to consistency with the Vision where it states that Segment 4 waters must support "any use." Also questioned is whether the "water+fish" standards from the Aquatic Life-Warm 2 Classification should apply. The Working Group also discussed if Segment 1 use classifications and standards should be applied to Segment 4 so that RFETS' surface waters would be treated equally within the Big Dry Creek drainage.]

B. Radionuclides

1. The action levels that apply throughout Segment 4 are based on 10^{-6} increased carcinogenic risks to human health from direct exposure which includes consumption.

2. The numerical values are:

0.15 pCi/l for plutonium
0.15 pCi/l for americium

These proposed radionuclide standards will necessitate a change by the WQCC.
[There is nonconsensus as to whether these values represent standards or action levels.]

C. Non-Radionuclide Points of Compliance/Radionuclide Points of Evaluation

1. In order to protect any use in this segment, as required by the Vision, and to protect surface water that is beyond DOE's control, the points of compliance/evaluation will be placed at the existing sampling locations for the outfalls of the terminal ponds (Ponds A-4, B-5, and C-2) in both Walnut and Woman Creeks.

2. Compliance/Evaluation will be measured using a 30-day moving average for those contaminants for which this is appropriate. When necessary to protect a particular use, acute and chronic levels will be measured differently as described in current sampling and analysis plans.

3. Since Woman Creek, with the exception of Pond C-2, is within Segment 4, exceedances of the standards and action levels at other existing surface water monitoring points on Woman Creek will trigger source evaluation and potential mitigation actions.

2.2.2 Vision Area 2 - Big Dry Creek Segment 5

In developing surface water action levels and standards for Segment 5, the Working Group found it very helpful to think in terms of an interim period during which the Vision is implemented and a final state at which the Vision is fulfilled.

The Working Group reached consensus that protection of surface water with respect to Vision fulfillment (End-State) would be the basis for making interim soil and ground water remediation and management decisions. However, during the interim period, different surface water standards and surface water management will be utilized.

The following sections describe the interim and final surface water standards and action levels.

A. Interim Period

1. Non-radionuclides

a) The water use classifications that will apply throughout this stream segment are based or current and potential surface water uses consistent with the Vision:

Aquatic Life – Warm 2
Recreation 2
Agricultural

b) The numerical standards for nonradionuclides in Segment 5 are listed in Table 2-2. Table 2-2 has been prepared from the following:

1) Metals and Inorganics:

- all temporary modifications currently in effect will be extended and will continue to apply.

- for all other metals, the lower of either the Aquatic Life values listed in Table III of the Basic Standards and Methodologies for Surface Water (5 CCR 1002-8, §3.1.0) **or** the Segment Specific Water Quality standards apply.

- for all other inorganics, Segment Specific Water Quality standards apply.

2) Organic Chemicals:

- all temporary modifications currently in effect will be extended and will continue to apply.

- for other key organic chemicals, temporary modifications may be developed through subsequent working group efforts. The basis for proposing these temporary modifications will be one or more of the following:

  1 **applying a mass-balance equation using the lowest value for each constituent within the standards associated with the four use classifications for Segment 4 of Big Dry Creek so as to be protective of Segment 4 waters and back-calculating maximum upstream concentrations that will maintain water quality at the points of compliance without allowing treatment within waters of the State, and/or**

  2 **calculating temporary modifications based on ambient conditions in a manner similar to the existing Segment 5 temporary modifications, and/or**

  3 **some other methodology agreed to by all parties.**

The Working Group recommends that these temporary modifica-tions be developed together with other stakeholders (i.e., the downstream cities at a minimum), prior to January 15, 1996. *This requires removal of the "water+fish" standards within the Aquatic Life - Warm 2 classification by the WQCC.*

[The Working Group did not reach consensus as to whether Segment 1 use classifications and standards should be applied to Segment 4 so that RFETS' surface waters would be treated equally within the Big Dry Creek drainage.]

- Key organic constituents for which temporary modifications could be developed include:

c) Points of Compliance for the non-radionuclides will be located at the outfalls of the terminal ponds. However, within the ponds and upstream in the main channel to the first influent gaging station, the standards and temporary modifications will act as action levels to trigger source evaluation and mitigation.

2. Radionuclides

a) Action levels that apply throughout Segment 5 are based on 10^{-6} risks to human health.

b) The numerical values are:

0.15 pCi/l for plutonium
0.15 pCi/l for americium

Both will be measured using 30-day moving averages.

c) Points of Evaluation will be located at the existing surface water monitoring locations influent to the ponds. Exceedance of of the action levels will trigger source evaluation and potential mitigation actions.

d) Higher event-related and/or seasonal (limited duration) action levels for each drainage will be developed through subsequent working group efforts based on existing baseflow and event data.

e) Points of Evaluation will be at the outfalls to the terminal ponds. Exceedance of either the 0.15 pCi/l or the higher event-related action level, whichever is in effect at the time, will trigger source evaluation and potential mitigation actions.

Many changes to existing standards and use classifications are proposed in Section 2.2.2. All would have to be agreed to by the WQCC.

B. Final End-State

When the final Vision is fulfilled and ASAP is implemented, the need for a separate and distinct Segment 5 is obviated. Therefore, the surface water standards for Segment 5 become equivalent to the Segment 4 standards as delineated in Section 2.2.1. Re-segmentation of Big Dry Creek at this point should be considered.

When the End-State is achieved, new monitoring and compliance/evaluation points will need to be delineated.
[DOE and Kaiser-Hill do not support including the "water+fish" values found within the Aquatic Life - Warm 2 classification for Segment 5 after the End-State is achieved. This is because, at End-State, limited water resources at the site make a viable fishery impractical.]

2.3 NON-COMPLIANCE ACTION DETERMINATIONS

A. When contaminant concentrations exceed the standards listed in Table 2-1 or Table 2-2, as appropriate, or the radionuclide action levels at a point of compliance/evaluation, source evaluation will be required. If mitigating action is appropriate, the specific action will be determined on a case-by-case basis, but will be designed such that surface water will continue to meet applicable surface water standards at the points of compliance.

B. Only when DOE and/or Kaiser-Hill (or appropriate sub-contractors) fail to report exceedance of the standards for a period longer than that defined in RFCA, or when DOE and/or Kaiser-Hill (or appropriate sub-contractors) fail to initiate the actions delineated above within 30 days of the known exceedance, will DOE and/or Kaiser-Hill be subject to statutorily defined fines and penalties.

2.4 SURFACE WATER MONITORING NETWORK

A. The surface water monitoring network will continue to operate as currently established unless subsequent changes are agreed to by all parties.

B. All parties will receive periodic surface water monitoring reports which will highlight any exceedances of surface water standards or action levels and any significant changes to surface water flow conditions.

NOTE: This surface water standards framework has been determined independent of any consideration of the contaminated effluent waste stream from the Temporary Treatment Facility (TTF). The TTF is envisioned to produce up to 150 pCi/l Pu waste water for an 8 to 10 year period as a result of residue treatment and consolidation.

3.0 GROUND WATER (12/7/95)

3.1 BASIS FOR ACTION LEVELS

Action levels for ground water must be protective of surface water standards and quality as well as the ecologic resources. As stated in the Conceptual Vision, domestic use of ground water at RFETS will be prevented through institutional controls. Since no other human exposure to ground water is foreseen by the Vision, ground water action levels are not based upon human health protection. This framework for ground water action levels assumes that all contaminated ground water emerges to surface water before leaving the site.

3.2 ACTION LEVELS

The strategy for ground water is intended to prevent contamination of surface water. This protectiveness can be achieved by applying Maximum Concentration Limits (MCLs) as ground water standards.

A. Tier I – Near-Source Action Levels for Accelerated Actions:

1. Action levels = 100 x MCLs (see Table 3-1).

2. Applies in areas of high ground water contaminant concentrations.

3. Designed to identify high concentration ground water "sources" that present a risk to surface water and should be addressed through an accelerated action.

B. Tier II - Surface Water Protection Action Levels:

1. Action levels = MCLs (See Table 3-1).

2. Designed to prevent ground water contaminated above ground water standards from reaching surface water by triggering ground water management actions when necessary.

3. Tier II Action Levels are to be measured in designated wells:

a) Tier II wells have been selected by all parties from the existing monitoring network where practical. New wells have been proposed where apparent gaps exist.

b) If the proposed new wells are shown to be contaminated or if additional plume information dictates, new or alternate wells will need to be chosen.

c) Tier II wells are currently uncontaminated. In general, Tier II wells are located between the downgradient edge of each plume and the surface water towards which the plume is most directly migrating.

d) Tier II wells are chosen without regard to the location of surface water points of compliance.

e) The designated Tier II wells are listed in Table 3-2.

3.3 ACTION DETERMINATIONS

A. Tier I

1. If Tier 1 action levels are exceeded, an evaluation is required to determine if remedial or management action is necessary to prevent ground water contaminated above ground water standards from reaching surface water. If this evaluation determines that action is necessary, the type and location of the action will be delineated and implemented as an accelerated action. This evaluation may include a trend analysis based on existing data. Accelerated action priority will be given to plumes showing no significant decreasing trend in ground water contaminant concentrations over 2 years.

2. Additional ground water that does not exceed the Tier I action levels may still need to be remediated or managed through accelerated actions or RODs to protect surface water quality or ecological resources and/or prevent action level exceedances at Tier II wells (e.g., lower-level, but fast-moving contamination). The plume areas to be remediated and the cleanup levels or management techniques utilized will be determined on a case-by-case basis.

3. Any accelerated actions will be taken in accordance with the Conceptual Vision document and incorporated into the Environmental Priority List.

B. Tier II

OPTION 1

1. **If concentrations in a Tier II well exceed MCLs during a regular sampling event, monthly sampling in that well will be required. Three consecutive monthly samples showing contaminant concentrations greater than ground water standards will require a ground water remedial action. These actions will be determined on a case-by-case basis, but will be designed to treat, contain, manage, or mitigate the contaminant plume.**

OPTION 2

1. **If contaminants consistently exceed standards at these wells, additional evaluation will be performed to determine if a remedial action is appropriate or required. If no increase in contamination to the immediate surface water is observed, and if the groundwater source is removed, these plumes will be left to naturally attenuate.**

2. Situations where ground water contaminated at levels above the ground water standards is currently or likely emergent into the surface water will trigger a Tier II action. These situations currently exist at:

   a. the OU 2 plume north of the Mound emergent into ponds B-1 and B-2,

   b. the OU 2 plume south of the 903 pad and Ryan's Trench likely emergent into Woman Creek,

   c. the Solar Ponds plume emanating north and likely emergent into Walnut Creek, and

d. the leachate emanating from the OU 7 Landfill and emergent into the unnamed northern tributary of Walnut Creek.

e. *[CCl_4 plume in 118.1]*

D. Other Considerations

1. Efficient, cost-effective, and feasible actions that are taken to remediate or manage contaminated ground water may not necessarily be taken at the leading edge of plumes, but rather at a location within the plume. Factors contributing to this situation could include technical impracticability at the plume edge, topographic or ecologic problems at the plume edge, etc. The parties recognize that this situation may result in a portion of a plume that will not be remediated or managed. This plume portion may cause exceedance of MCLs at Tier II wells or exceedance of surface water standards. When an up-gradient ground water action is taken that results in this situation, DOE and Kaiser-Hill may request relief from the ground water and/or surface water standards. CDPHE and EPA will evaluate the request and may grant temporary relief or alternate concentration limits for a specific area. Soil or subsurface soil source removals will not be considered as the sole justification for alternate concentration limits. In addition, alternate concentration limits will be determined such that surface water use classifications are not jeopardized and surface water quality does not exceed standards at points of compliance.

2. Ground water plumes that can be shown to be stationary and do not therefore present a risk to surface water, regardless of their contaminant levels, will not require remediation or management. They will require continued monitoring to demonstrate that they remain stationary.

3.4 GROUND WATER MONITORING NETWORK

A. The ground water monitoring network will continue to operate as recently modified unless subsequent changes are agreed to by all parties. Analyte suites, sampling frequency, and specific monitoring locations will be evaluated annually to adjust to changing hydrologic conditions including plume migration.

55

B. All groundwater monitoring data as well as changes in hydrologic conditions and exceedances of groundwater standards will be reported quarterly and summarized annually to all parties.

C. If quarterly reporting shows that previously uncontaminated wells are contaminated above ground water standards, the sampling frequency will be increased to monthly. Three consecutive monthly samples showing exceedances will trigger an evaluation to determine is a remedial or management action is necessary.

D. All ground water plumes that exceed the ground water standards must continue to be monitored.

E. All ground water remedies, as well as some soil remedies, will require ground water performance monitoring. The amount, frequency, and location of any performance monitoring will be based on the type of remedy implemented and will be determined on a case-by-case basis within decision documents.

3.5 GROUND WATER CLASSIFICATIONS

A. Three classifications currently apply to ground water at RFETS:

1. Domestic Use Quality

2. Agricultural Use Quality

3. Surface Water Protection

B. Because the Conceptual Vision restricts ground water use in all areas, CDPHE would support DOE and Kaiser-Hill in requesting that the domestic use and agricultural use classifications be removed by petitioning the WQCC.

56

4.0 SUBSURFACE SOIL (12/7/95)

4.1 ACTION LEVELS

Action levels for subsurface soil are protective of:

A. human exposure appropriate for uses described in the Conceptual Vision document,

B. surface water standards via ground water transport, and

C. ecological exposure appropriate for uses described in the Conceptual Vision document.

4.2 ACTION LEVELS: THE SUBSURFACE SOIL ACTION LEVELS HAVE BEEN CALCULATED USING A TWO-TIER APPROACH.

A. Tier I:

1. All subsurface soils capable of leaching volatile organic compounds to groundwater at concentrations greater than or equal to 100 x MCLs.

2. Contaminant-specific Tier I action levels have been determined using a soil/water partitioning equation and a dilution factor from EPA's Draft Soil Screening Guidance (1994). These derived values and the parameters used to derive them are listed in Table 4-1. The subsurface media characteristics for these calculations are based on site-specific data or conservative values where representative site values cannot be determined. Where subsurface characteristics in a particular area within RFETS differs significantly from those chosen as representative of the entire site, those alternate values should be used.

3. No Tier I action levels have been determined for non-volatile contaminants due to their generally limited mobility in soil.

B. Tier II:

1. Human exposure to subsurface soil is envisioned only in the Industrial Area (Area 1 of Conceptual Vision). Therefore, Tier II action levels protective of human exposure are calculated on the basis of Construction Worker exposure. This includes dermal contact with and direct ingestion of subsurface soils; inhalation of

particulates and VOCs; and external irradiation. The attached Tables 5-1 through 5-5 provide the equations and parameters used to calculate the subsurface soil action levels. Table 5-6 presents the calculated action levels derived for this exposure scenario.

Possible non-consensus exists concerning how a 15 mrem/year dose limit might be applied.

2. Additional subsurface soil may need to be remediated or managed to protect surface water quality via ground water transport or ecological resources. Subsurface soil presenting unacceptable ecological risks (HI $\geq$ 1) identified using the approved ecological risk assessment methodology will be evaluated for remediation or management.

4.3 ACTION DETERMINATIONS

A. Tier I: When contaminant levels in subsurface soil exceed Tier I action levels, subsurface soil source removals will be triggered. These removals will be accomplished through accelerated actions.

B. Tier II: When contaminant levels in subsurface soil exceed Tier II action levels or when an action is necessary to protect surface water or ecological resources, a process to identify, evaluate, and implement efficient, cost-effective, and feasible remediation or management actions will be triggered.

1. Actions may be implemented by means of an accelerated action or addressed as necessary in the ROD for the affected area.

2. Actions taken to protect construction workers in the Industrial Area exposure may include remedial actions or the creation of institutional controls. *[An implication of the Conceptual Vision is that there will be a cost associated with the remediation or management of areas in the Industrial Area that will be made available for future industrial use.]*

3. Where remedial actions to protect ecologic resources can be implemented without damaging other ecologic resources, remediation and/or management actions will be implemented.

C. Appropriate remedial or management actions will be determined through this evaluation process on a case-by-case basis, and may include the removal, treatment, disposal, or in-place stabilization of contaminated subsurface soils.

D. Single geographically isolated data points of subsurface soil contamination above the Tier I or Tier II action levels will be evaluated for potential source magnitude. These single points will not necessarily trigger a source removal, remedial, or management action, depending on the source evaluation.

E. The need to excavate below the water table for source removal actions will be determined on a case-by-case basis.

F. Any accelerated actions will be taken in accordance with the Conceptual Vision document and incorporated into the Environmental Priority List.

5.0 SURFACE SOIL (12/7/95)

5.1 BASIS FOR ACTION LEVELS

Surface soil will be defined to be the upper six inches of soil. Action levels for surface soil are protective of:

A. human exposure appropriate for uses specified in the Conceptual Vision document,

B. surface water quality via runoff, and

C. ecological exposure appropriate for uses specified in the Conceptual Vision document.

5.2 ACTION LEVELS:

The surface soil action levels are calculated on the basis of protection of appropriate human exposure. All surface soil contaminated at levels above the action levels will be remediated or managed in such a way as to mitigate the unacceptable human exposure.

A. Action levels for non-radionuclides are human-health risk-based (10^{-6}) for the appropriate land-use receptor. The attached Tables 5-1 through 5-5 provide the

equations and parameters used to calculate the soil action levels. Table 5-6 presents the calculated action levels for these exposure scenarios:

1. Industrial Area (Area 1 of Conceptual Vision): Action levels will be based on Office Worker exposure. This includes dermal contact with and direct ingestion of surface soil, inhalation of particulates and VOCs, and external irradiation.

2. Inner Buffer Zone (Area 2 of Conceptual Vision): Action levels will be based on Open Space Recreational User exposure. This includes dermal contact with, incidental ingestion of, and particulate inhalation of dust, surface soil or dry sediment, and external irradiation.

B. Two action levels for radionuclides are established:

1. Radiation dose limit of 15 mrem per year. This dose limit is based on EPA's proposed 40 CFR 196, *EPA Radiation Site Cleanup Regulation* and equates to a 10^{-4} risk level.

2. Human-health risk-based (10^{-6}) for the appropriate land-use receptor as described in Section 5.2.A above. The calculated values associated with these exposure scenarios are listed in Table 5-6.

C. Additional soil may need to be remediated or managed to protect surface water quality via runoff or ecological resources. The amount of soil and the protective remediation levels and/or management technique will be determined on a case-by-case basis.

5.3 ACTION DETERMINATIONS

A. Non-radionuclides: When contaminant levels in surface soil exceed action levels, or when an action is necessary to protect surface water or ecological resources, a process to identify, evaluate and implement efficient, cost-effective, and feasible remediation or management actions will be triggered. Appropriate remedial or management actions will be determined through this process on a case-by-case basis, and may include the removal, treatment, disposal, or in-place stabilization of contaminated surface soils.

B. Radionuclides: The type of action taken depends on which of the action levels has been exceeded.

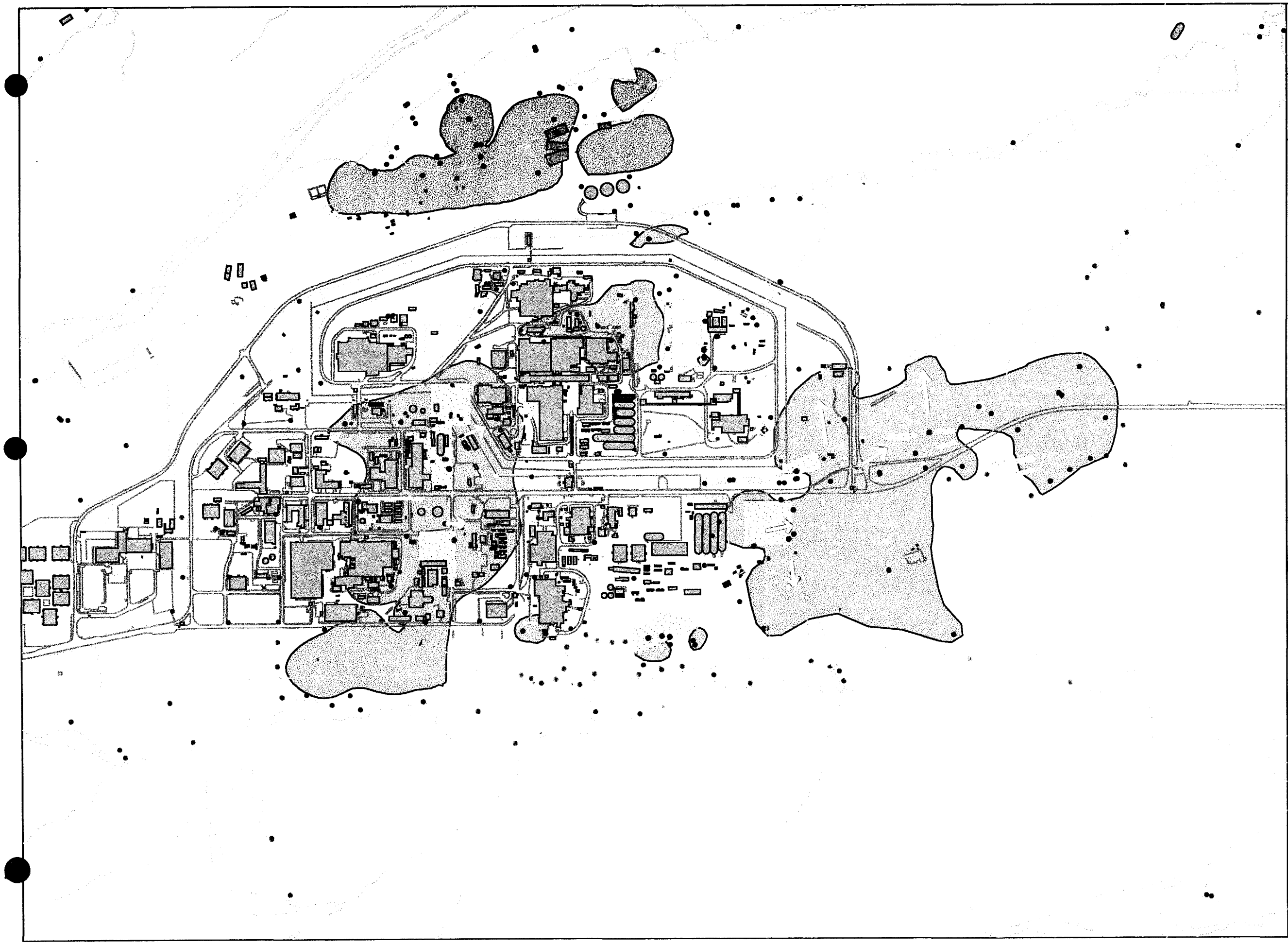
1. Surficial soil will be actively remediated if the aggregate annual dose limit is exceeded.

2. Surficial soils exhibiting an aggregate radionuclide risk above 10^{-6} will be managed. Management may include, but is not limited to, "hotspot" removal, capping, or designating land uses that preclude unacceptable exposure.

C. These actions may be implemented by means of an accelerated action or addressed as necessary in the ROD for the affected area.

D. Any accelerated actions will be taken in accordance with the Conceptual Vision document and incorporated into the Environmental Priority List.

61



Composite Plume For Concentrations > MCL's

Contamination extent boundaries represent groundwater sampling results for TCE, PCE, CCl4, and VC.

LEGEND

Groundwater Flow Direction
Well With Contam. > 100 X MCL's
UHSU Wells
Buildings
Suspected VOA Source
Pavement
Surface Drainage
Concentrations > MCL's

N

400 0 400 800 Feet

Figure 4-1
December 21, 1995

Potential Remedial Actions with Composite Plume Extent for Concentrations > 100 X MCI's

Contamination extent boundaries represent groundwater sampling results for TCE, PCE, CCl4, and VC.

LEGEND

- Groundwater Flow Direction
- OU 7 Remediation Installation
- Remediation Installations
- Containment Wall
- Plume Intercept Location
- Well With Contam. > 100 X MCL's
- UHSU Wells
- Buildings
- Suspected VOA Source
- Pavement
- Surface Drainage
- Concentrations > 100 X MCL's

N

400 0 400 800 Feet

Figure 4-2

December 21, 1995